A

Synopsis of thesis entitled

" Investigation on control of *Fusarium oxysporum* on Soybean (*Glycine max)* crop by selected medicinal plant"

Submitted

To

Swami Ramanand Teerth Marathwada University,

Nanded

For registration of Ph. D in

Microbiology

Under the faculty of science

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Dist. Latur-41351

April 2022

Index

Abstract of proposed work plan/problem:

1. Introduction.

2. Review of literature and development in the subject.

3. Aims and Objective of Research/ Proposed Hypothesis.

4. Methodology to be adopted.

5. Importance of Study/ Society application:

- International status.
- National Status.
- Significance of the study.

6. Proposed work Plan/ Formulation and Structure of Study.

- Year-wise Plan of work and targets to be achieved.

7. References:

" Investigation on Control of *Fusarium oxysporum* on Soybean (*Glycine max)* Crop by Selected Medicinal Plant"

Abstract

As the nation is developing the farming technique, to increase the production, pathogens are getting evolute in their action and causing the number of losses to the farmers. With the huge use of synthetic pesticides trouble is observing in every point of view from, environmental pollution to the resistance in the pathogens. The medicinal plants are main solution using from the decades by number of scientist and that is getting the success. As the medicinal properties of the plants are changing according to the region and geographical condition in my research topic, I will be going to select the medicinal plants of Wadawal bet and will check their inhibitory action against the Fusarium oxysporum of soyabean crops fungal disease.

Introduction

Fungal pathogens cause, a large loses in the crop yield, quality, marketing and all of these will affect to the economic ratio of the farmers losses due to disease about 14% worldwide (Agrios, 2005) and 20% for major foods and cash crops (Oerke *et al.*, 1994). Soybean (*Glycine max (L.)* is the one of important cash crop in the world. It is the important oil seed crop as well as used in production of paints, soaps, varnishes, glycerines, candies, printing ink, plastic industries and fibre industries. of products. Approximate calculation shows that, total production of soybean crop in India for the year 2021 is 118.889 lakh tons. It is major limiting factor in soybean production. But sometimes due to the attack of different pests, the loss in yield of soyabean is observed, approximate universal loss is about 26.3%, Oerke, (2007). Fusarium is a most commonly occurring species causing disease on soyabean (*Glycine max (L.)* crop. Fusarium species are soil borne pathogenic fungus, during the favorable conditions of growing, post-harvest and storage conditions they infect to plants and cause spoilage of plants root to plant foliar system, also infect to kernels and grains. (Smith, 1986). *Fusarium oxysporum* is the most important species that cause number of infections in soyabean, it can cause wilt and root rot disease of soybean. The wilt Infection can occur at any growth stage, but more often at early vegetative and reproductive stages, in root rot species infect and colonize soybean roots and stems.

For reducing these loses due to diseases, from the decades farmers are using the chemical fertilizers. (Sohbat Bahraminejad 2011). Apart from this beneficial effect the large use of these chemical or synthetic pesticides there are lots of harmful effects on environment, animals, human beings, soil properties, resistance development in pathogens observed because of the toxic non-targeted action. (Rai and Carpinella, 2006; Kagale *et.al.,* 2004) and non-biodegradable nature (Tegegnea G *et.al.,* 2008, Castillo F *et.al.,* 2010). In 1986 National Academy of Sciences (NAS) report on pesticide residues on food, that fungicides pose more of a carcinogenic risk than any synthetic insecticides and herbicides together (Research Council, Board of Agriculture 1987). Even of all these benefits and side effects, the synthetic pesticides are very expensive because of the less availability confirm fast acting agents.

The harmful nature causes to develop new strategies to prepare the environment friendly and easily biodegradable natural products from the last two decades (Mamdouh *et.al.*,2007, Gnanamanickam, 2002). As we know that in nature lots of biodiversity is there and it is a richest house of plants which are store house of natural chemicals that could be used against any pathogens (Satish *et.al.,* 2009). An analysis of the papers published in Journal of Natural Products in the last decade reveals that among the different types of organisms investigated for antifungal properties: 41 % were plants; 34 %, fungi; 20 %, marine organisms and 5 %, bacteria.

Plant metabolites (primary and secondary) and pesticides are better alternatives to harmful synthetic pesticides known to be have minimum effects on environment and danger to consumer as compared to synthetic pesticides (Varma *et al.,* 1999; Hussain *et al.,* 2014).

Number of biological activities are given by the plant components like anti-inflammatory, anticarcinogenic and anti-atherosclerotic, antibacterial, antifungal, antiviral, antimutagenic and antiallergic activities (Ikken *et al.,* 1999; Noguchi et al., 1999). Antioxidant content cause to give these biological activity (Chung *et.al.,* 1998). Plant synthesizes number of chemical compounds such as phenols, alkaloids, flavonoids, glycosides, steroids, saponins, tannins, resins and essential oils which in different plant parts such as bark, root, leaves, flowers, fruits and seeds etc. (Tonthubthimthong *et.al.,* 2001). Such compounds are not directly linked with functions of growth and reproduction of plants, but they are gained during adaptive defence mechanisms against biotic and abiotic stresses, and interactions with the environment and helps to fight against pathogenic organism (Olívia Matos *et.al.,* 2013).

Even though of large discoveries on plant pathogenic action by many medicinal plant parts, the different discoveries are running there so as to combat new resistant pathogens, because of the differences in quality and quantity of essential products produced due to change in environmental condition, soil nature, geographic location, plant parts, family of plants and extraction techniques (Sohbat Bahraminejad *et.al.,* 2011).

Review of literature and development in the subject

Jun *et.al., (1995)* evaluated that, there are number of plants in the nature that haves stimulatory and inhibitory effects on the growth of plants and the microorganisms in contact of them that effect, allelopathy, can be used to reduce the plant fungal diseases associated with soil borne pathogens. Mason JR, *et.al., 1996)* Most of the vegetables are infected by plant pathogens in Saudi Arebia, the plants like *Amaranthus spinosus, Barbeya oleoides, Clutia lanceolata, Lavandula pubescens, Maerua oblongifolia and Withania somnifera used to control pathogens.* Wilson *et.al.,* (1997) evaluated that, Essential oil and plant extract of Palmarosa (*Cymbopogon martini*), Red thyme (*Thymus zygis*), Cinnamon leaf (*Cinnamomum zeylanicum*), and Clove buds (*Eugenia caryophyllata*) contains D-limonene, cineole; β-myrcene; α−pinene, β− pinene; and camphor help in showing antifungal activity against B. cinerea. Tiina *et.al., (2000)* studied that, Medicinal plants have number of components that helps in inhibiting the growth of pathogenic microorganisms and now a days that are most useful to inhibit growth of resistant pathogenic organisms they are used to inhibit the plant pathogens growth. C. D. Jasso *et.al.,* (2005) studies, *Aloe vera* leaf pulp, tested for antifungal activity against human and plant pathogens. Malabadi, *et.al.,* (2007) evaluated that, Karnataka state plants *Acacia pennata, Anaphalis wightiana, Capparis pepiaria* and *Catunaregum spinosea* used for studying the inhibition of plant fungal pathogens. Sunog (2007) studied, Korean *Cuminum cyminum* (cumin), *Cymbopogon citratus* (lemongrass), *Eucalyptus citriodora (*lemon eucalyptus*), Origanum vulgare (*oregano*), Thymus vulgaris* (red thyme) antifungal activity against soil and postharvest borne plant fungal pathogens.

Il-Kwon *et.al.,* (2008) evaluated, 27 Korean medicinal plants tested at different concentration against six phytopathogenic fungi the efficacy varies with plant pathogen, tissue sampled and plant species. Zakaria (*2008)* studied that, Pesticides which are synthetically prepared are costly as compared to plant originated pesticides. Hui-Ting Chang *et.al.,* (2008) evaluated, T-muurolol and α-cadinol component of *Calocedrus macrolepis* var. *formosana* Florin and tested for the antifungal activity against the plant fungal pathogens. Asha *et.al.,* (2009) evaluated Nepalian plant parts, prepared crude extract *Allium sativum, Capsicum annuum, Artimesia vulgaris, Eupatorium adenophorum, Gaultheria fragrantissima and Phyllanthus emblica* and tested for antifungal activity of dry potato tuber rot disease. Abdurrahman *et.al.,* (2012) studied, the aqueous extracts obtained from leaves, roots and flowers *of Turkian Trachystemon orientalis (L.)* and applied against five plant pathogen fungi. M. Amini *et.al.,* (2012) studied, Effectiveness of 3 Iranian medicinal plants oils *Zataria multiflora, Thymus vulgaris and Thymus kotschyanus* on plant pathogenic fungus, effectiveness of essential oils MIC and MFC varies along the species. GSibi *et.al.,* (2012) *Muntingia calabura* L. studied different plant part extracts, tested for the potential of inhibiting the fungal plant pathogens. This inhibition activity mainly due to the presence of tannins in the plant. Hazia *et.al.,* (2013) evaluated, the inhibitory activity of five Srinagar plant extracts viz. *Artemisia absinthium* L., *Rumex obtusifolius* L., *Taraxacum officinale* Weber ex Wiggers, *Plantago lanceolata* L. and *Malva sylvestris* L, tested for fungal pathogens of fruit plants and vegetables. Nazihah (2013) studied, Causative pathogen of black pod of cocoa, *Phytophthora palmivora (Butl.) Butl,* inhibited for their growth by using plant crude extract Cosmos caudatus Kunth grown in Malaysia. Maryam *et.al.,* (2013) studied, five native plants *Satureja bachtiarica, Zataria Multifera,*

Achillea millefolium, Ziziphora clinopodioides and *Thymus daenensis* tested for potential to inhibit the growth of *Rhizoctonia solani* present in potato growing field.

Steliana *et.al.,* (2014) evaluated, Four Romanian plants absinth *(Artemisia absinthium*), rosemary *(Rosmarinus officinalis),* jimson weed (*Datura stramonium*) and cocklebur (*Xanthium strumarium*) for antifungal activity against *Alternaria alternata* pathogenic fungus. Mohamed *(*2014) studied, Chemical analyses and antimicrobial activities of essential oils of eighteen Egyptian plants, *Artemisia judaica*, *A. monosperma*, *Callistemon viminals*, *Citrus aurantifolia*, *C. lemon*, *C. paradisi*, *C. sinensis*, *Cupressus macrocarpa*, *Cupressus sempervirens*, *Myrtus communis*, *Origanum vulgare*, *Pelargonium graveolens*, *Rosmarinus officinalis*, *Syzygium cumini*, *Schinus molle*, *S. terebinthifolius*, *Thuja occidentalis* and *Vitex agnus-castus* tested for antimicrobial activity against the plant pathogenic fungus and bacteria of crown gall *Agrobacterium tumefaciens.* Farzana *et.al.,* (2014) studied the, Fusarium wilt in tomato was assessed for controlling by using the medicinal plant extract of *Piper betel* (Pan), *Lowsonia inermis* (henna tree), *Psidium guajava* (guava), Carica papaya(papaya), Moringa oleifera (drumstick tree), *Mimosa pudica* (touch-me-not), *Catharanthus roseus* (bright eyes), *Adhatoda vasica* (Malabar nut) and *Andrographis* (Andrographis) grown in Bangladesh. Silva *et.al.,* (2014) studied the, Etiological agents of coffee plant and are tried to cured by using the different Brazilian medicinal plants aqueous extract like of *Allium sativum, leaves of Vernonia polysphaera, Cymbopogon citratus, Cymbopogon nardus, Cordia verbenacea, Eucalyptus citriodora, Ricinus communis, Azadirachta indica, Piper hispidinervum and flower buds of Syzygium aromaticum*.

*Maria et al., (*2016) studied that, Brazil which highest producer of Pineapple get infected with the fungal diseases, Now a days application of chemical fungicide gives the negative impact, therefore the disease control is carried out by using the medicinal plants containing a spectrum of secondary metabolites such as alkaloids, quinones, flavonoids, glycosides, saponins, tannins and terpenoids. Salome *et.al.,* (2016) evaluated that, Number of plants produce secondary metabolites that have antimicrobial properties, are screened and used to produce the herbal chemical pesticides, so most of economic losses in fruit caused due to the fungal species are checked for growth inhibition with help of medicinal Leaf extracts of selected South African plant species *Bucida buceras, Breonadia salicina, Harpephyllum caffrum, Olinia ventosa, Vangueria infausta and Xylotheca* kraussiana. Sultan *et.al.,* (2017) studied that, Algerian wild plants like *Artemisia herba alba, Cotula cinerea, Asphodelus tenuifolius*, and *Euphorbia guyoniana* that are used to inhibit the growth of fungal pathogens, mostly infecting agents of the agriculturally important cereal plants.

Aims and Objective of Research/ Proposed Hypothesis

- Isolation of fusarium oxysporum pathogens from soybean crop plants.
- Collection, identification and selection of medicinal plants from the Wadawal Nagnath bet of Latur dist.
- Observation of antifungal activity of medicinal plants in in-vitro and in-vivo condition.
- Analysis of phytochemical activity of medicinal plants
- Study of mechanisms of antifungal activity.
- Comparison between synthetic fungicides and medicinal fungicides.

Material and Methods to be Adopted

Materials:

1. Plant collection:

Medicinal plants *Calotropis procera (Ruchki), Datura stramonium (Datura), Ocimum sanctum (O. tenuiflorum) (Tulsi), Holarrhena pubescens* (Indrajav), *Lantana camara* (common lantana) etc are collected from the Wadawal Nagnath of Latur dist. And are identified by taking the help of Botanist and agriculturist.

Methods:

1. Isolation and morphological study of *Fusarium oxysporum* fungal pathogens from soyabean plant.
2. Medicinal plant collection and extract preparation.
3. *In vitro* antifungal activity testing.
4. Bio-content analysis and antioxidant activity testing
5. *In vivo* antifungal activity testing.
6. Study of mechanisms of antifungal activity.

Importance of Study/Society application

International status:

-M. Hashem (2010), studied to evaluate the effectiveness of some natural safe essential oils in control of cumin root rot disease to reduce the pollution they used Cumin, Rose geranium and sweet basil oil to control disease. G. S. Isaac *et.al*., (2014), Studied the in vitro antifungal activity of medicinal plant *Adhatoda vasica, eucalyptus globulus, lantana camara, Nerium oleander and Ocimum basilicum e*xtracts against *fusarium oxysporum* of tomato wilt. Sohbat Bahraminejad et al., (2015) studied the effect of some Methanolic crude extract of medicinal and ornamental plant extracts against *Fusarium oxysporum*, 50% inhibition is shown by *Haplophyllum perforatum and Calendula officinalis.* Siddiqui *et.al.*, (2016), studied the efficacy Of *Nerium Oleander* extracted in aqueous, methanol, ethanol, choloroform and acetone against *fusarium oxysporum.*

National status

L. R. Rathod *et. al.*, (2012), studied the seeds were treated with leaf extracts of plants like, *Azadirachta indica A. Juss., Acacia nilotica (L.) Del., Datura stramonium L., Polyalthia longifolia (Sooner.) Thw., Allium sativum L. and Annona squamosa* against the fusarium pathogen. Dr. S. Bhosle (2015), during research work studied about the fungal disease of soyabean and cured the disease by using different weed plant extract like *Celosia argentea, Lantana camara, Argemone maxicana, Hemidesmus indicum, Parthenium hysterophorus, Tridax procumbens.*

Significance of study:

From present study, the medicinal plant is searched having antifungal activity. will be applied against the *Fusarium oxysporum* sever infecting agent of soybean. In future the spray of extract will be prepared which will be easily applied against the disease by farmers. As these are economically affordable and eco-friendly products, can be used by farmers for many times without developing resistance in pathogens.

Proposed Work plan:

Year wise work plan with targets to be achieved:

First Year:

- Course work
- Study on review of literature.
- Observation of infected soybean crop.
- Isolation and Identification of *Fusarium oxysporum*.

Second Year:

- Selection of medicinal plants, preparation of medicinal extracts in different solvents.
- Study of antifungal activity of different plant extract in petri plate.
- Study of antifungal activity of different plant extract on plant pot and fields.

Third Year:

- Study of effect of antifungal activity using different dilutions and determination of MIC.
- Study of mechanisms of antifungal activity.
- Bio-content analysis of positive antifungal extracts by different methods.

Fourth Year:

- Remaining work and thesis writing.

Future prospective

1. Low coat spray.
2. Making database for future researchers.

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Research Student — Research Guide

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